G_{Ep}-III in Hall C

Measurement of G_{Ep}/G_{Mp} to Q^2=9 GeV^2 via Recoil Polarization

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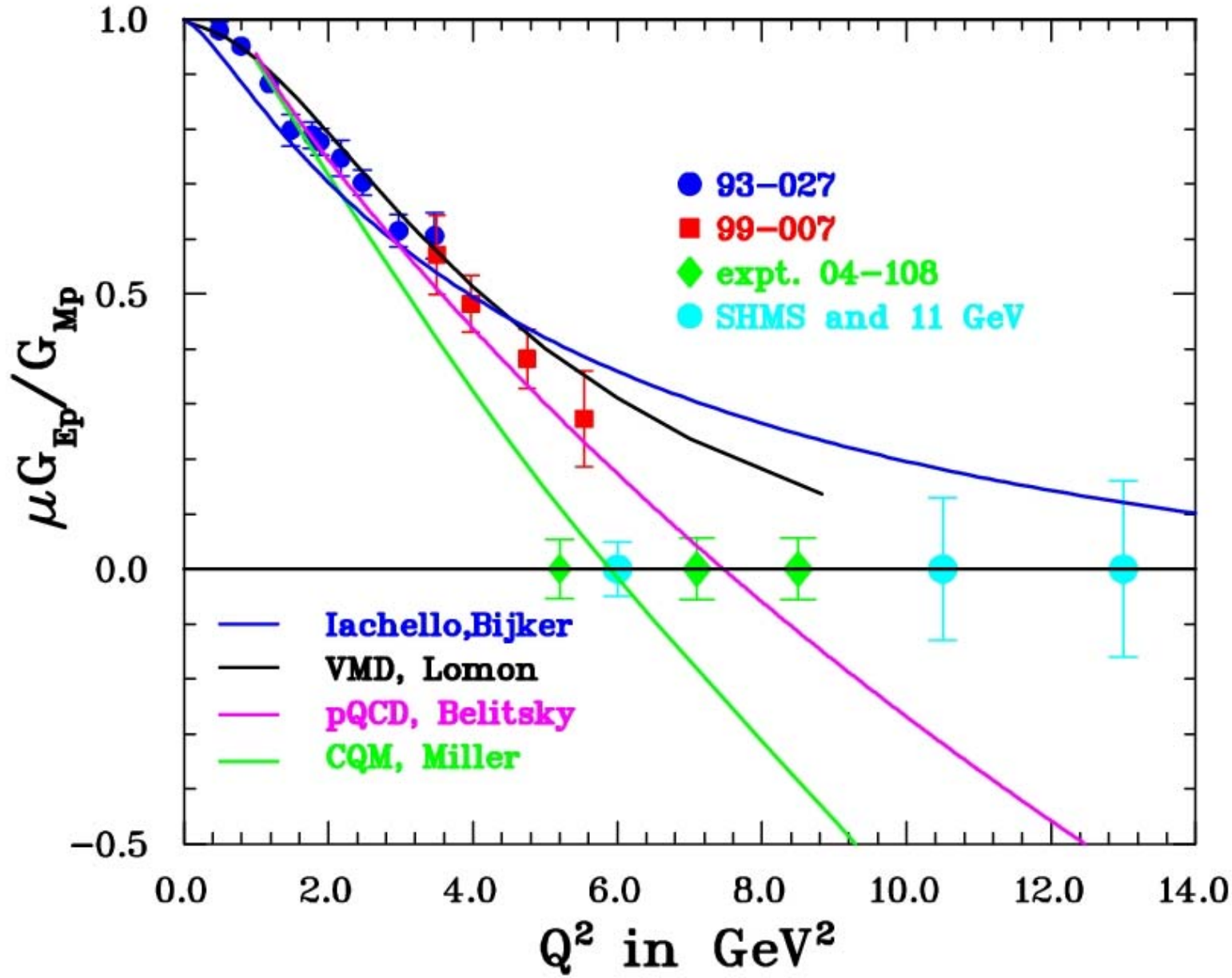
Overview of the Experiment

- Continuation of the very successful program in Hall A to higher momentum transfer
- Theories diverge from one another beyond the current data
- Experiment requires new EM Calorimeter (BigCal), a new scattering chamber, and a new FPP in the HMS spectrometer
- Also requires a new coincidence trigger, and an updated HMS trigger (with new S0 scintillator)


1.0
0.5
0.0
−0.5
$\mu G_{Ep}/G_{Mp}$
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
Q^2 in GeV^2
93−027
99−007
expt. 04−108
SHMS and 11 GeV
Iachello,Bijker
VMD, Lomon
pQCD, Belitsky
CQM, Miller

Logistics

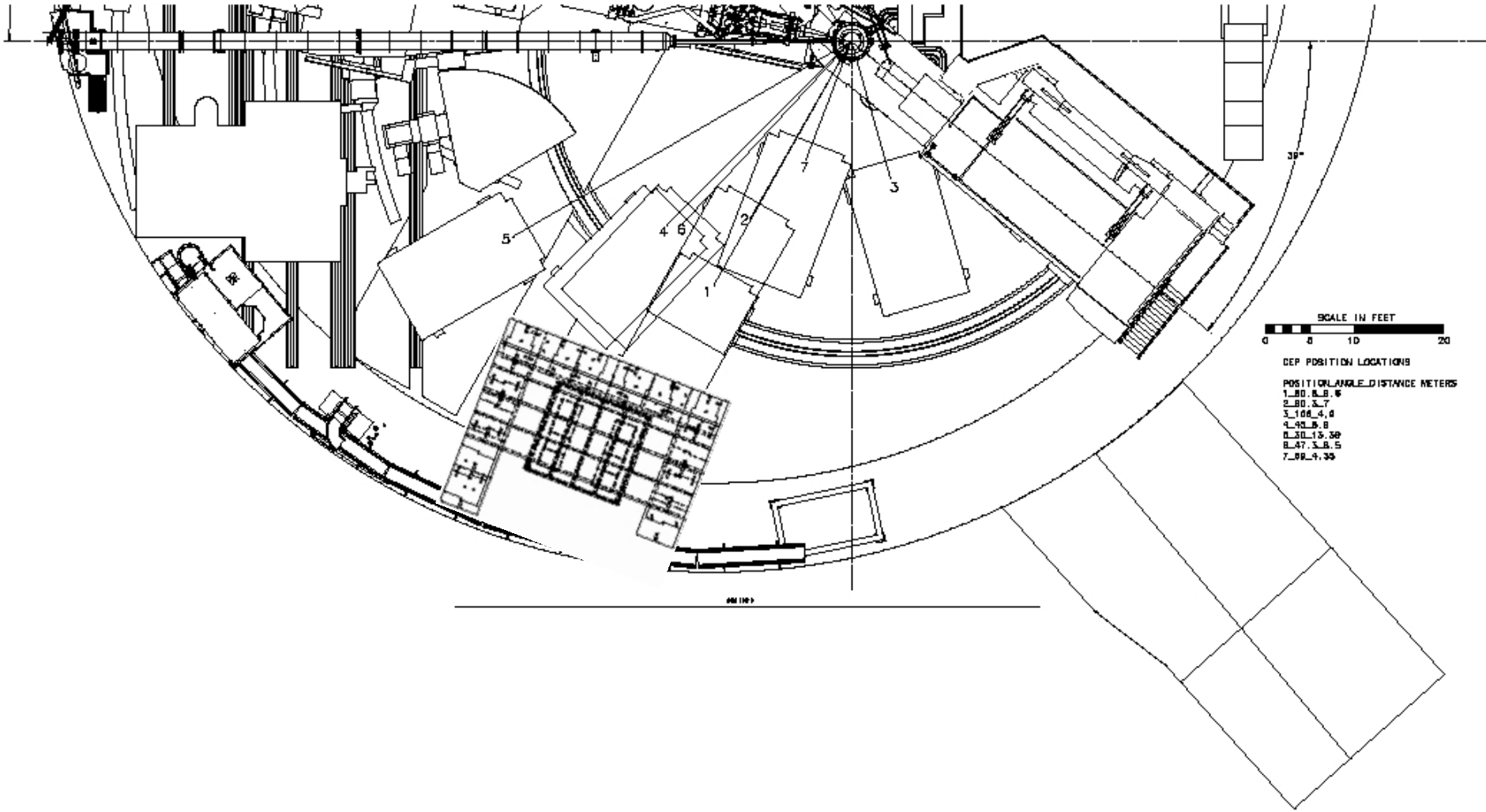
- This experiment will run simultaneously with the 2-Gamma Polarization experiment
- Three kinematics points – 5.2, 7.0, 8.X GeV^2 – the highest Q2 is sensitive to the available beam energy!
- The 2-Gamma experiment has three kinematic points, and together with a test point, we have seven positions of the calorimeter in the hall
- The distance from the target varies, depending on solid angle matching and angular resolution requirements

Logistics, cont'd

Kin.Setting	E_{beam} (GeV)	Q^2 (GeV^2)	p_p (GeV / c)	E_{scat} (GeV)	$theta_e$	t_p (GeV)	$theta_p$	P_l	P_t	dp_3 / dp_4
1	2.528	2.700	2.1841	1.089	59.4	1.439	25.407	-.1877	0.8548	-0.91880
2	4.045	5.200	3.5887	1.274	60.3	2.771	17.960	-.0637	0.9243	-0.96748
3	1.867	2.513	2.0752	0.528	106.0	1.339	14.155	-.1448	0.9776	-0.91119
4	2.839	2.500	2.0676	1.507	44.9	1.332	30.985	-.1928	0.7347	-0.91062
5	3.650	2.500	2.0676	2.318	31.5	1.332	35.905	-.1618	0.5782	-0.91062
6	5.714	7.100	4.6277	1.930	47.3	3.784	17.853	-.0082	0.8860	-0.98006
7	5.740	8.500	5.3868	1.210	67.2	4.530	11.950	0.0217	0.9681	-0.98517
7	5.800	8.700	5.4949	1.164	69.2	4.636	11.417	0.0248	0.9722	-0.98573

Logistics, cont'd

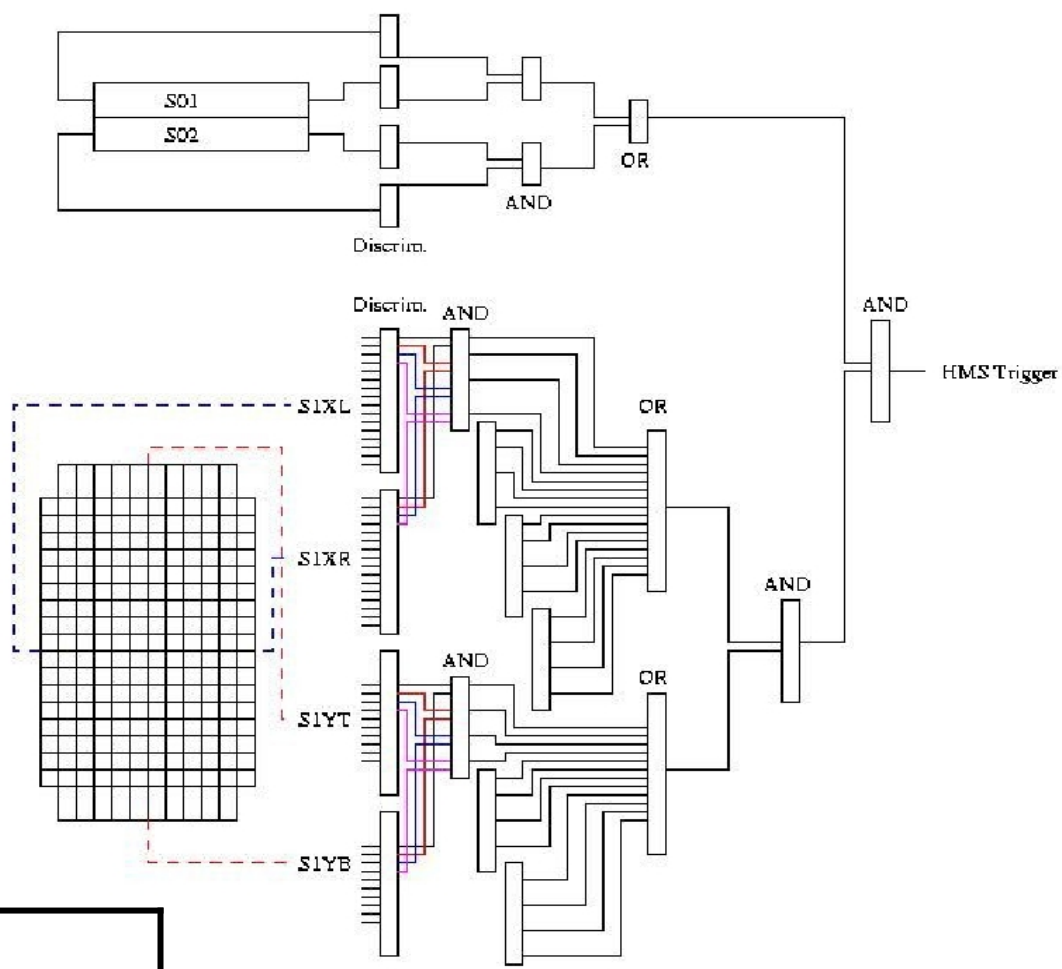
- Major Challenges
  - Where do we place electronics racks and cable delay racks?
  - How do we maintain accessibility for all seven kinematics points?
  - How do we shield the electronics?
  - What sort of cable/dolly system might we use?


1
2
3
4
5
6
7
39°
SCALE IN FEET
0
5
10
20
CEP POSITION LOCATIONS
POSITION_ANGLE_DISTANCE METERS
1_80.5_8.6
2_80.3_7
3_166_4.4
4_45_5.8
5_30_15.39
6_47.3_5.5
7_98_4.33

Experiment Trigger

- Installation of FPP requires removal of S2 scintillator layer
- Elastic kinematics means that "interesting" protons are confined to a small region of the focal plane
- New S0 scintillator – 2 paddles (in x) with double end readout, to capture elastic + radiative tail
  - Scintillators and mounting frame have been constructed already
- HMS/BigCal trigger will be formed in the hall – TS will be located in the hall, in the BigCal electronics racks – ongoing tests of this setup in the testlab
- Necessitates formation of HMS trigger in the HMS hut

HMS Flight Time	85 ns
PM Transit	50 ns
Cables to Crate	30 ns
Trigger Formation	60 ns
	215 ns
Transit to BigCal	250 ns
	465 ns
Coincidence Trigger	30 ns
TS	80 ns
Total	**575 ns**



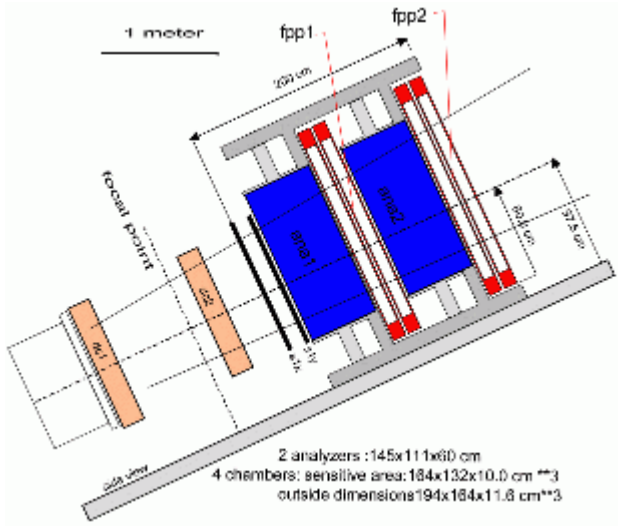
Flight Time	20 ns
PM Transit	30 ns
Cable to Crate	40 ns
MUX	15 ns
Delay Cable	500 ns
Total	**605 ns**

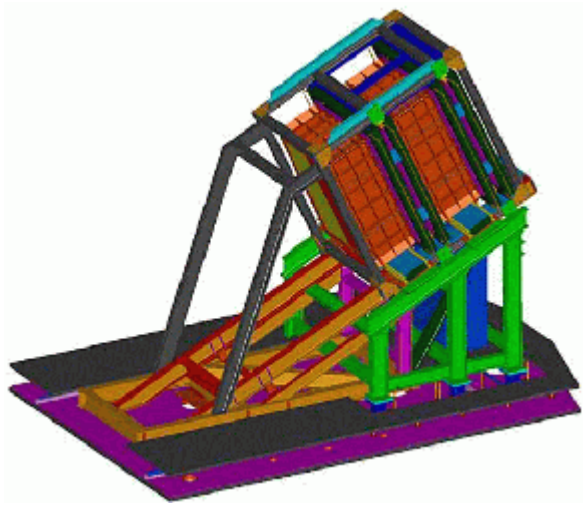
Scattering Chamber

Focal Plane Polarimeter

- Active Area: 166cm (V) x 132 cm (H)

- Two Successive Polarimeters: CH_2 Analyzer & two 3-layer Drift Chambers Each (UXV wire orientations)



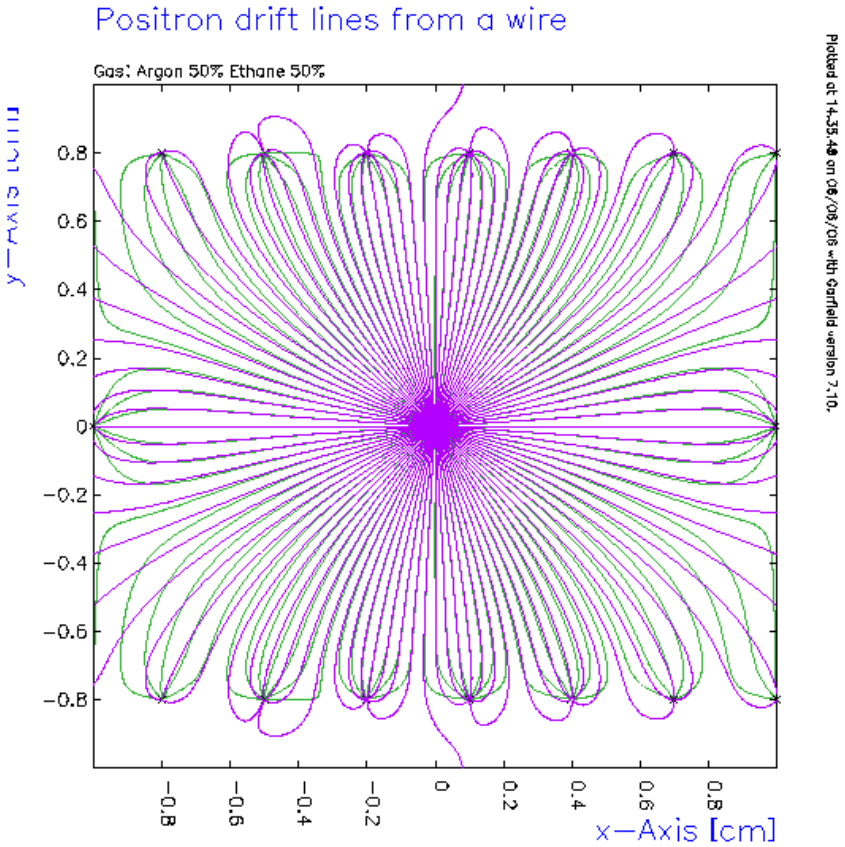


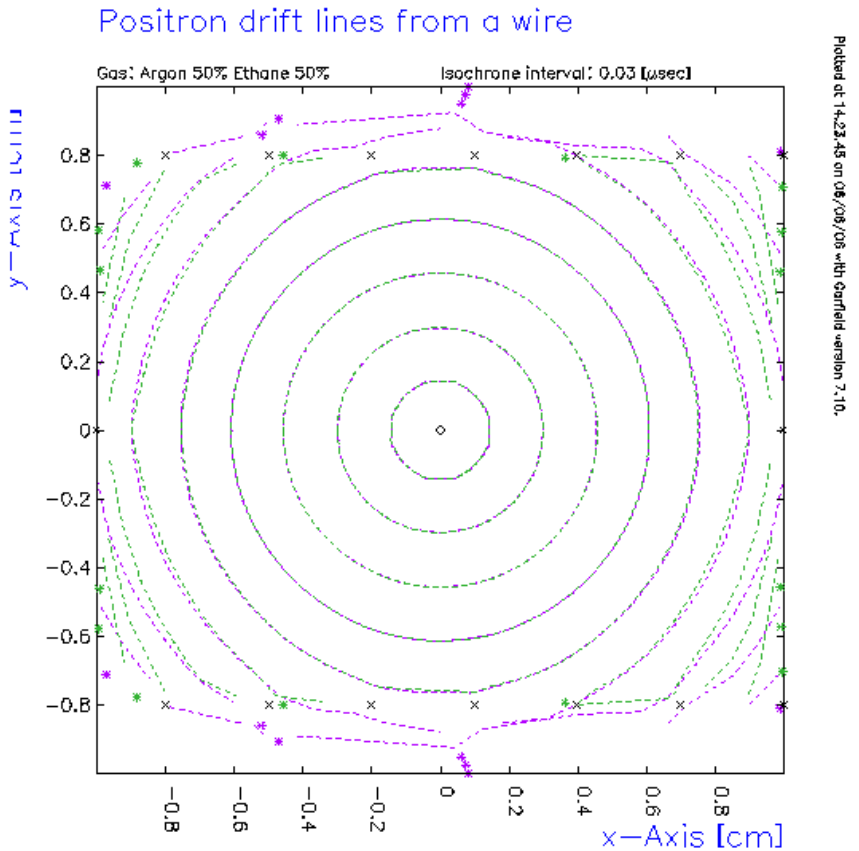
FPP Testing in EEL

- All four chambers mounted horizontally for cosmic testing in FPP space frame
- Scintillator paddles mounted above and below to form trigger
- VME-based DAQ system, as will be used in the experiment
- New JLab F1 TDC's
- Limited to one chamber pair at a time, currently; simple DAQ system only handles single VME crate readout

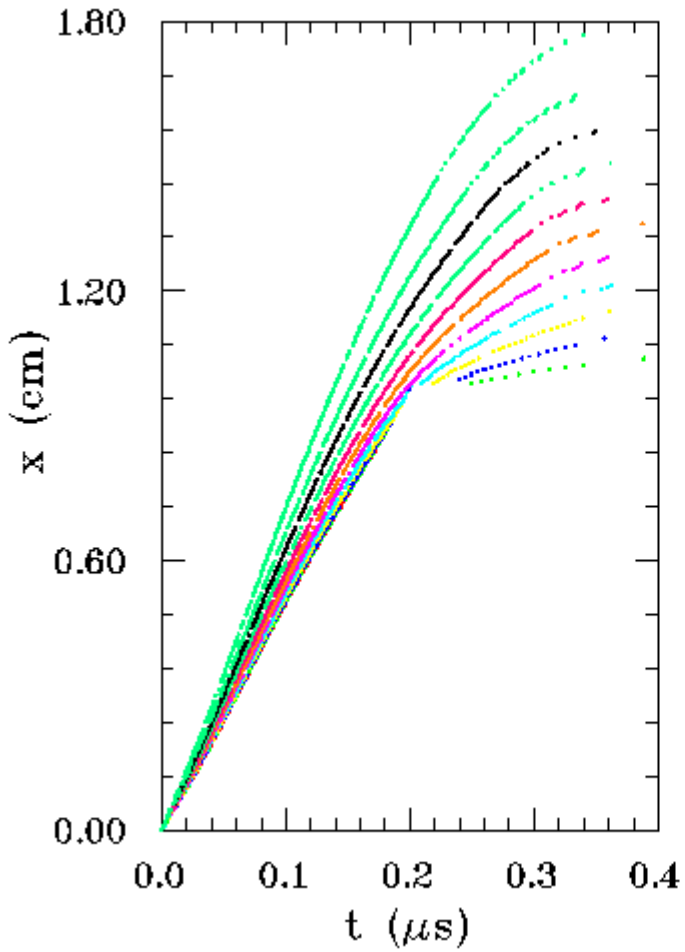
Drift Simulations with Garfield

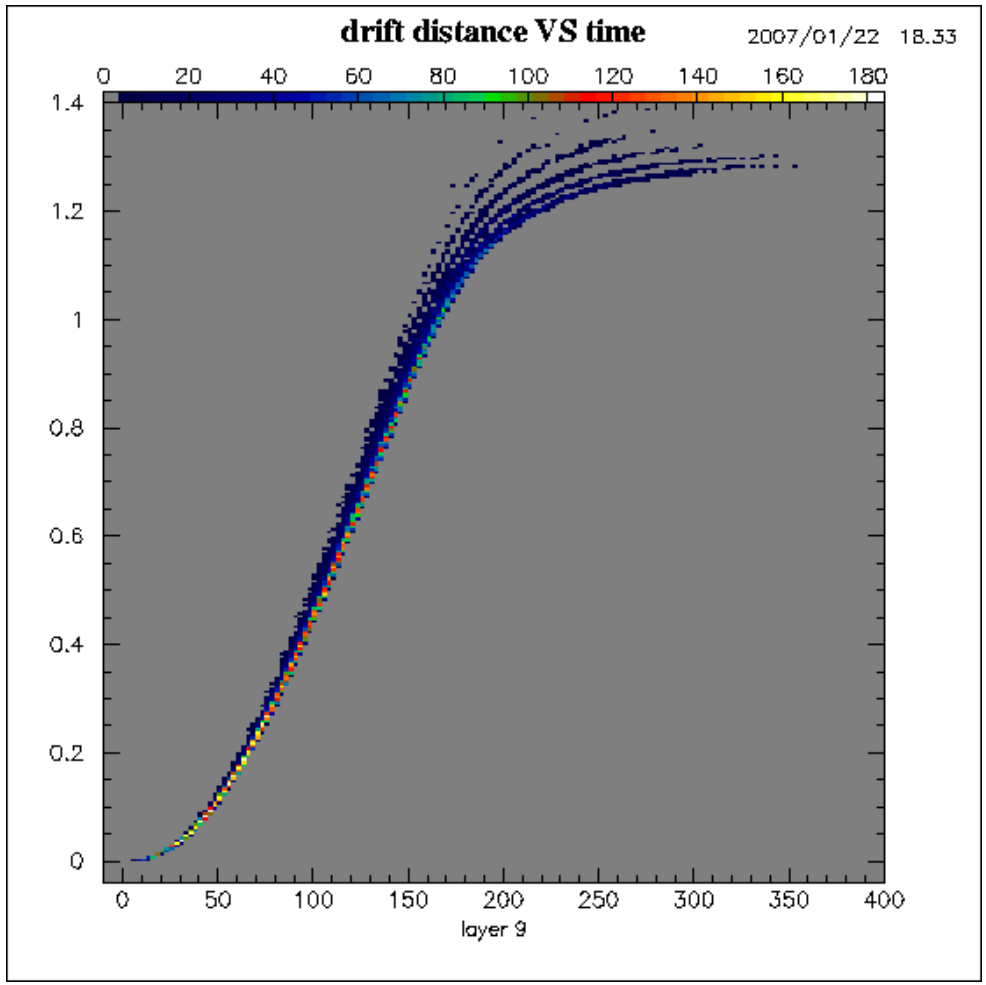
(Mehdi Meziane)



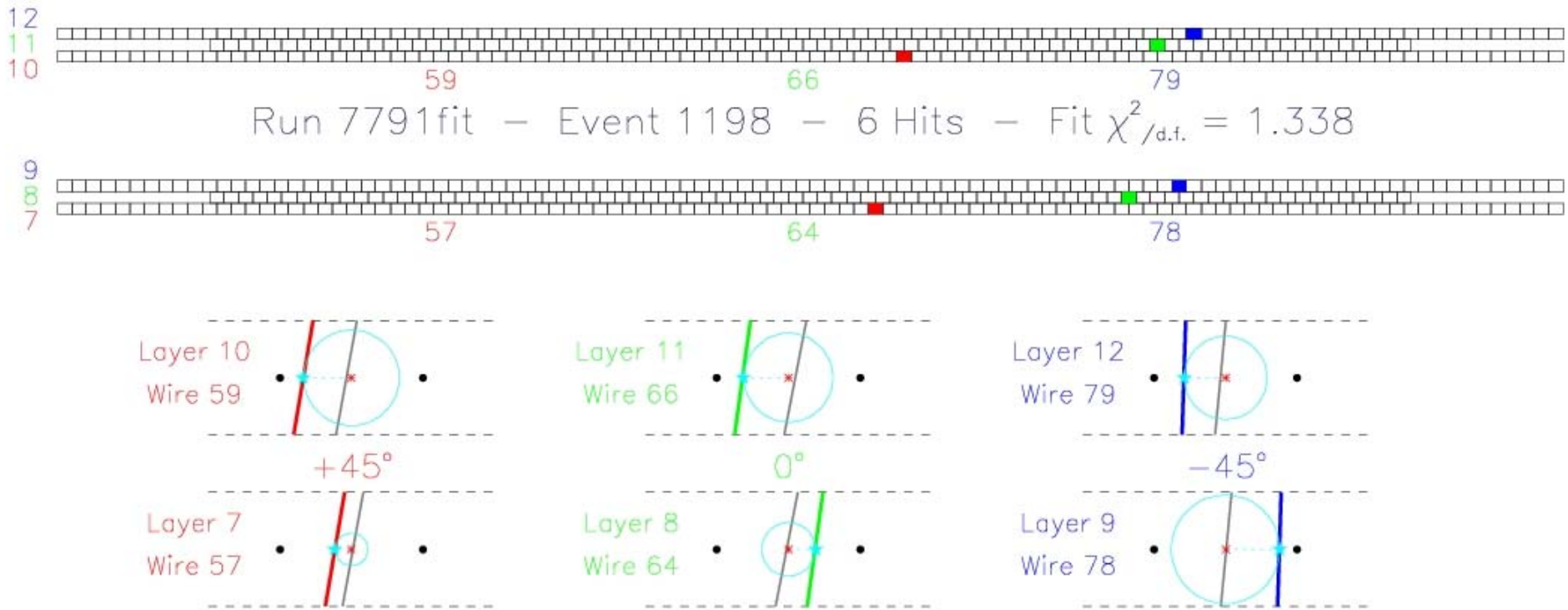


Drift Simulations with Garfield

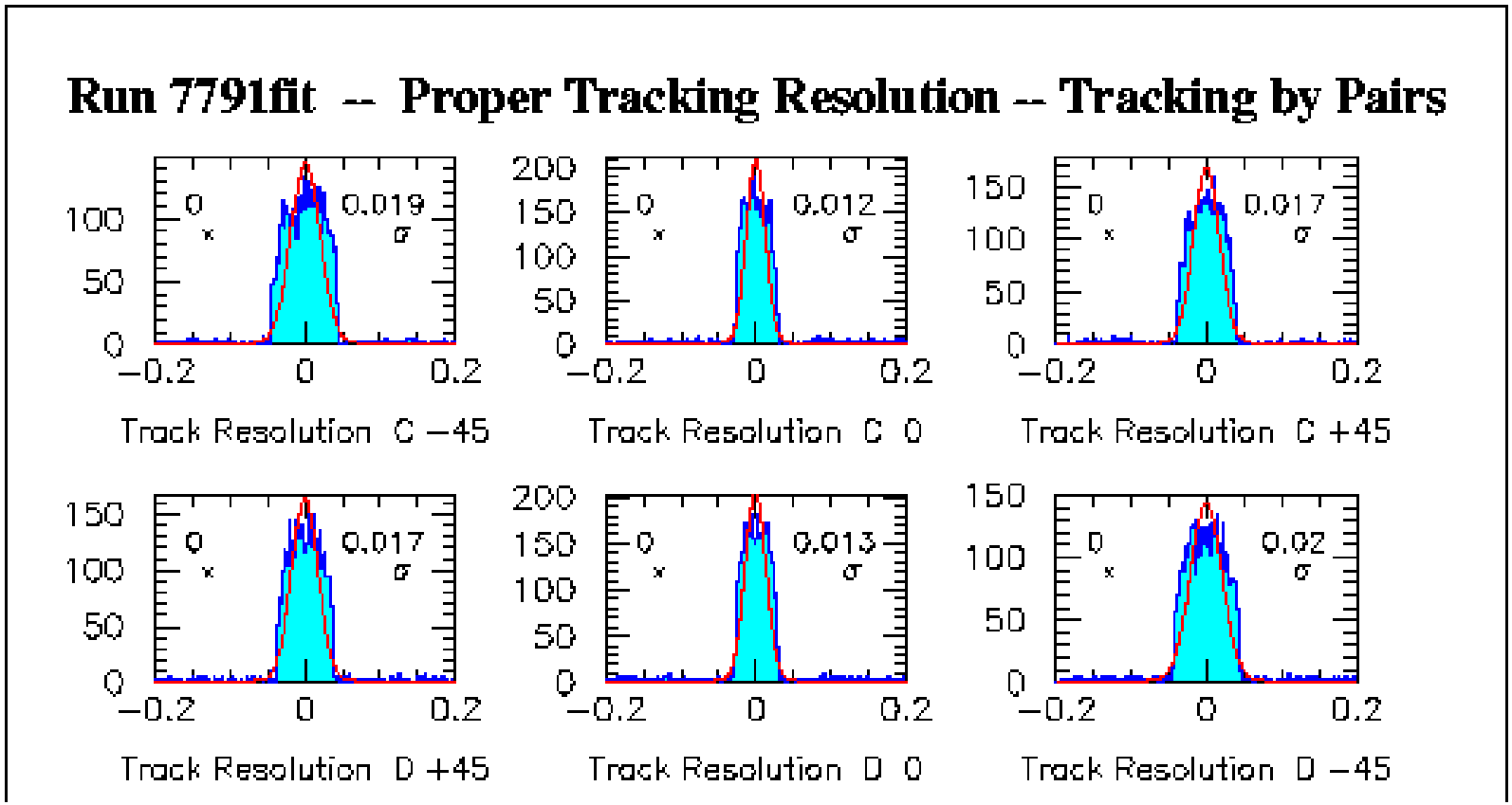




Event Display - Individual Tracks



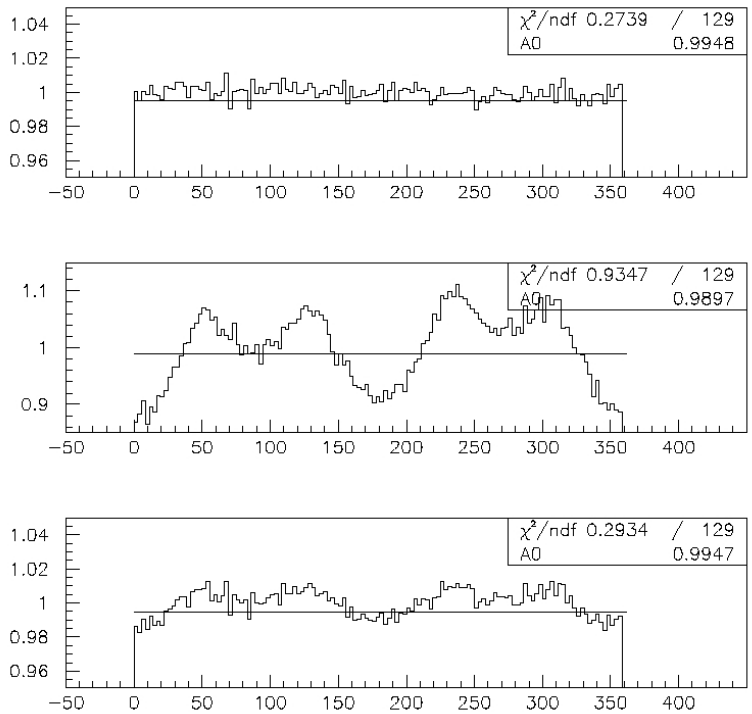
Drift Simulations with Garfield



- Tracking resolution is ~200 um or better … this meets spec already
- Non-gaussian shape of resolution plots indicates further improvement may be possible … work is ongoing

GEANT Simulation of FPP

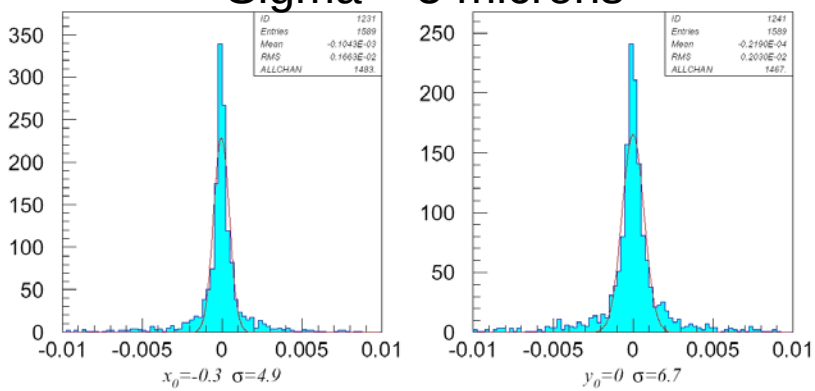
- full description of new FPP chambers and analyzers in GEANT
- New implementation of a fully 3-D "conetest"
- Initial studies indicate that false asymmetries are significantly reduced
- < 10^{-3} asymmetries

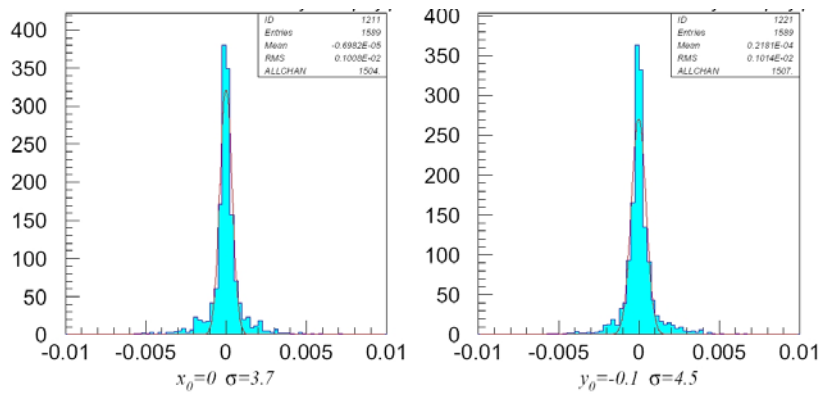


Analysis of Simulated Tracks

- "golden" tracks from GEANT simulation
- Possible to turn on/off MS, energy loss, hadronic scattering
- Initial generation of "straight-thru" tracks (no MS/ELOSS/HADR)
- track parameters from simulation compared to those from FPP software

Sigma ~ 5 microns





Sigma ~ 0.3 mr

Summary and Outlook

- Performance of FPP at or beyond specs
- Tracking software is reaching final development stages (tests in EEL will continue …)
- Full analysis software, and incorporation into the Hall C engine, will continue over the next several months
- Installation of FPP must come after small experiments – test installation will expediate the process
- And now, on to the 2-Gamma experiment, and a full description of progress on BigCal …